Stoller
Grand Junction Office established 1959

299-E33-01 (A4838)
Log Data Report

Borehole Information:

Borehole: 299-E33-01 (A4838)			Site: 216-B-43 Crib		
Coordinates (WA St Plane)		GWL (ft)[1]: 234.75		GWL Date: 09/02	
North	East	Drill Date	TOC[2] Elevation	Total Depth (ft)	Type
137614	573632	08/54	635.44	239.5	cable tool

Casing Information:

Casing Type	Stickup (ft)	Outer Diameter (in.)	Inside Diameter (in.)	Thickness (in.)	Top (ft)	Bottom (ft)
Steel (welded)	2.5	8.625	8.0	0.3125	0	235
Steel (welded)	0.8	4.50	4.0	0.25	0	214

Borehole Notes:

The casing depth information provided above is derived from a well construction and completion summary obtained from Ledgerwood (1993), corrected to the current TOC. The casing size information for the 4-in. and 8-in. steel casings was confirmed from tape and caliper measurements collected in the field by Stoller personnel. The groundwater level was measured from the TOC by Duratek well services personnel. The coordinates and TOC elevation are derived from HWIS[3].

This borehole was originally drilled in 1954. It is reported an 8-in. casing had been placed to 235 ft in depth. The interval from 235 to 240 ft was grouted. A 4-in. casing was introduced inside the 8-in. casing to a depth of 214 ft. The 8-in. casing was perforated at two cuts per foot from 0 to 208 ft. Grout was placed between the 4-in. and 8-in. casings from the ground surface to 214 ft in depth, where a packer was set. The well construction between 215 and 235 ft is not documented.

Logging Equipment Information:

Logging System: Gamma 2B		Type: SGLS (35%)
Calibration Date: 09/02	Calibration Reference:	GJO-2002-287-TAR
	Logging Procedure:	MAC-HGLP 1.6.5, Rev. 1

Spectral Gamma Logging System (SGLS) Log Run Information:

Log Run	1	2	3	4	5
Date	10/03/02	10/04/02	10/07/02	10/07/02	10/08/02
Logging Engineer	Spatz	Spatz	Spatz	Spatz	Spatz
Start Depth (ft)	3.0	110.0	239.0	204.0	141.0
Finish Depth (ft)	23.0	22.0	205.0	140.0	109.0
Count Time (sec)	200	200	100	200	200
Live/Real	R	R	R	R	R
Shield (Y/N)	N	N	N	N	N
MSA Interval (ft)	1.0	1.0	0.5	1.0	1.0
ft/min	n/a[4]	n/a	n/a	n/a	n/a

Log Run	1	2	3	4	5
Pre-Verification	BB144CAB	BB146CAB	BB147CAB	BB147CAB	BB148CAB
Start File	BB145000	BB146000	BB147000	BB147069	BB148000
Finish File	BB145020	BB146088	BB147068	BB147133	BB148032
Post-Verification	BB145CAA	BB146CAA	BB147CAA	BB147CAA	BB148CAA

Log Run	6 Repeat				
Date	10/08/02				
Logging Engineer	Spatz				
Start Depth (ft)	60.0				
Finish Depth (ft)	36.0				
Count Time (sec)	200				
Live/Real	R				
Shield (Y/N)	N				
MSA Interval (ft)	1.0				
ft/min	n/a				
Pre-Verification	BB148CAB				
Start File	BB148033				
Finish File	BB148057				
Post-Verification	BB148CAA				

Logging Operation Notes:

Spectral gamma logging was performed in this borehole during October 2002 on four separate days. Logging was conducted without a centralizer on the sonde because the borehole diameter was too small. Logging measurements are referenced to the top of the 8-in. casing. A repeat section was collected in this borehole to evaluate system performance.

Analysis Notes:

Analyst:	Henwood	Date:	10/14/02	Reference:	GJO-HGLP 1.6.3, Rev. 0

Pre-run and post-run verifications of the logging system were performed for each day's log event. The acceptance criteria were met.

Casing corrections for 0.3125-in.- and 0.25-in.-thick casings were applied for the 8-in. and 4-in. steel casings, respectively. Where more than one casing exists at a depth the casing correction is additive (e.g., an 8-in. and 4-in. casing would be the correction for 0.3125 + 0.25 = 0.5625).

Data were acquired for 100 sec at 0.5-ft depth intervals during log run 3 between 205 and 239 ft in depth rather than 200 sec at 1-ft intervals in the remainder of the borehole. This change was made to reduce logging time while improving the spatial resolution of the measurements. On the basis of Ledgerwood (1993), it was presumed there was a single casing in this interval. Measurements for the gamma rays (e.g., 662 keV for ^{137}Cs, 1333 keV for ^{60}Co, 1460 keV for ^{40}K, and 2614 keV for ^{232}Th) appear to be adequate at the 100-sec counting time. However, the naturally occurring ^{238}U as measured with either the 609-keV or 1764-keV gamma rays was not detected above the MDL at some depth locations. The cause of this lack of detection is probably the result of an elevated background resulting from the existence of relatively higher ^{60}Co concentrations.

Each spectrum collected during a log run was processed in batch mode using APTEC SUPERVISOR to identify individual energy peaks and determine count rates. Concentrations were calculated with an EXCEL worksheet template identified as G2Bsep02.xls using an efficiency function and corrections for casing, water, and dead time as determined from annual calibrations. Dead time corrections are applied where dead times exceed 10.5 percent; dead time did not exceed this value in this borehole. A correction for water was applied to the data below 235 ft in depth.

Log Plot Notes:

Separate log plots are provided for the man-made radionuclides (^{137}Cs and ^{60}Co) detected in the borehole, naturally occurring radionuclides (^{40}K, ^{238}U, ^{232}Th [KUT]), a combination of man-made, KUT, and dead time, and total gamma plotted with dead time. In addition, a comparison log plot of man-made radionuclides is provided that compares data collected with a Westinghouse Hanford Company's Radionuclide Logging System (RLS) with SGLS data. This plot is included to assess the possibility of movement of contaminants in the vadose zone. For each radionuclide, the energy value of the spectral peak used for quantification is indicated. Unless otherwise noted, all radionuclides are plotted in picocuries per gram (pCi/g). The open circles indicate the minimum detectable level (MDL) for each radionuclide. Error bars on each plot represent error associated with counting statistics only and do not include errors associated with the inverse efficiency function, dead time correction, casing corrections, or water corrections. Repeat log sections for naturally occurring and man-made radionuclides are also included.

Results and Interpretations:

^{137}Cs and ^{60}Co were the man-made radionuclides detected in this borehole. ^{137}Cs was detected between 45 and 85 ft in depth with two separate intervals of contamination shown at 48 ft (500 pCi/g) and 69 ft (60 pCi/g). These two intervals suggest lateral migration of contaminants from the 216-B-43 Crib that is approximately 22 ft west of this borehole. ^{137}Cs was also detected between 211 and 214 ft and between 220 and 225 ft in depth at a concentration of about 1 pCi/g. It is possible historical water levels rose as high as the 205-ft level, leaving residual contamination in the sediments as the groundwater receded to its current levels at about 235 ft.

^{60}Co was detected below 30 ft in depth almost continuously to the total depth of the borehole. Relatively higher concentration intervals exist between 70 and 103 ft, at 153 ft, 161 ft, and between 207 and 240 ft in depth; the maximum ^{60}Co concentration was 37 pCi/g at 227.5 ft. Breakthrough of contaminants to groundwater is suggested.

The KUT log profiles are essentially featureless. The dual casings and grout result in significant gamma attenuation. On the basis of low ^{40}K concentrations, the depth interval from 165 to 213 ft appears to have been most affected by grout relative to the remainder of the borehole. However at 15 ft, apparent ^{40}K activities are about 10 pCi/g increasing to about 12 pCi/g, suggesting a transition from the coarse-grained sediments of the Hanford H1 to the finer grained sediments of the Hanford H2.

A comparison log plot of data collected in 1991 by the Westinghouse Hanford Company RLS and in 2002 with the SGLS is included. The RLS concentration data (^{137}Cs and ^{60}Co) were decayed to the date of the SGLS logging event in October 2002. The maximum calibrated casing correction for the RLS in 1991 was 0.40 in., which may result in a slight underestimation of concentrations where dual casings are in place from the ground surface to about 214 ft in depth. The comparison, however, shows good agreement in the profile between the logging systems. Changes in the ^{60}Co concentrations that would indicate possible contaminant movement are shown between 183 and 198 ft and between 228 and 235 ft, although this assessment should not be considered conclusive. Additional monitoring would be useful to determine if contaminant movement is continuing.

The repeat section indicated good agreement of the man-made radionuclides and the naturally occurring KUT.

References:

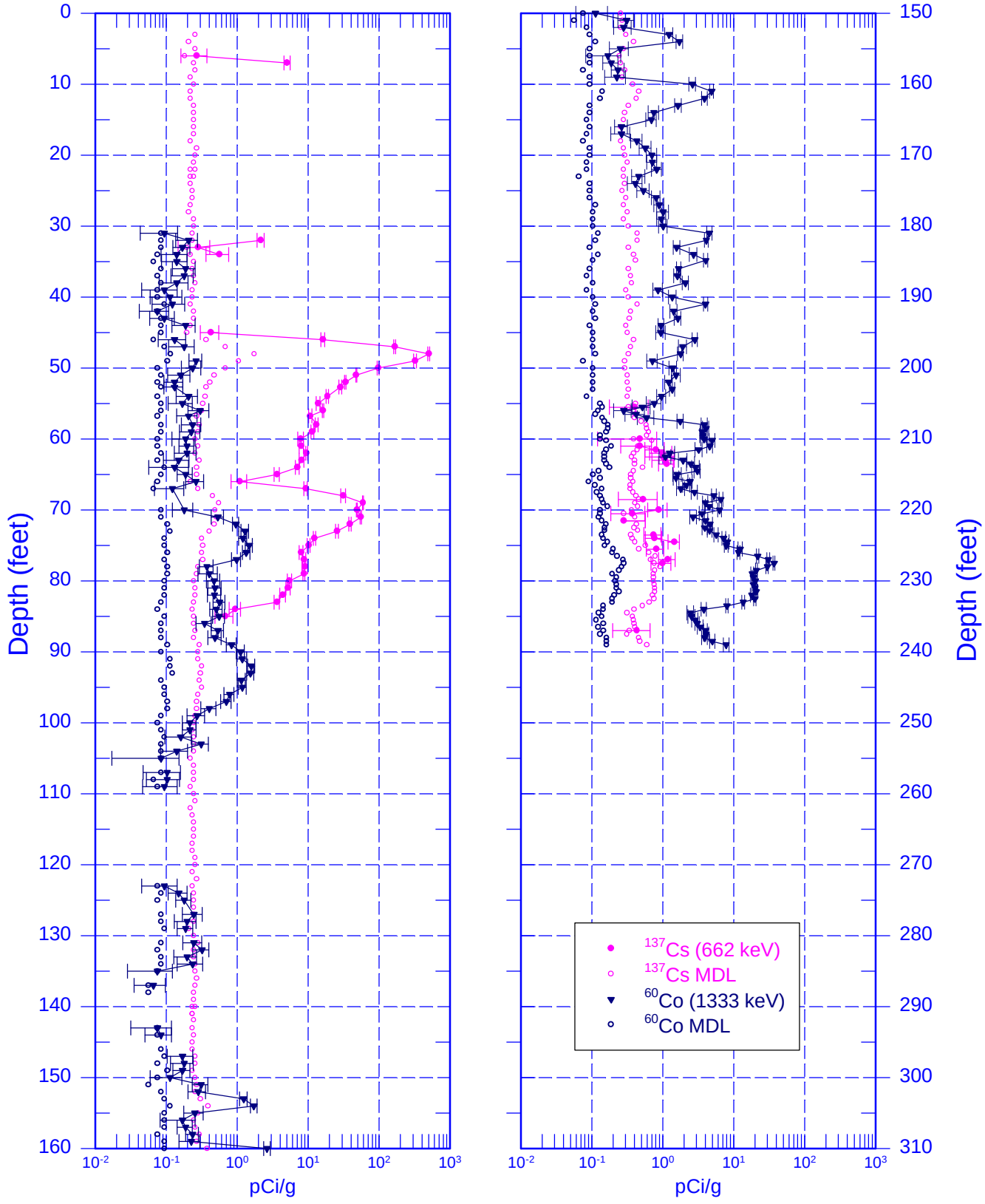
Ledgerwood, R.K. 1993. *Summaries of Well Construction Data and Field Observations for Existing 200-East Resource Protection,* WHC-SD-ER-TI-007, Revision 0, Westinghouse Hanford Inc., Richland, Washington.

---

[1] GWL – groundwater level
[2] TOC – top of casing
[3] HWIS – Hanford Wells Information System
[4] n/a – not applicable

299-E33-01 (A4838)

Man-Made Radionuclide Concentrations

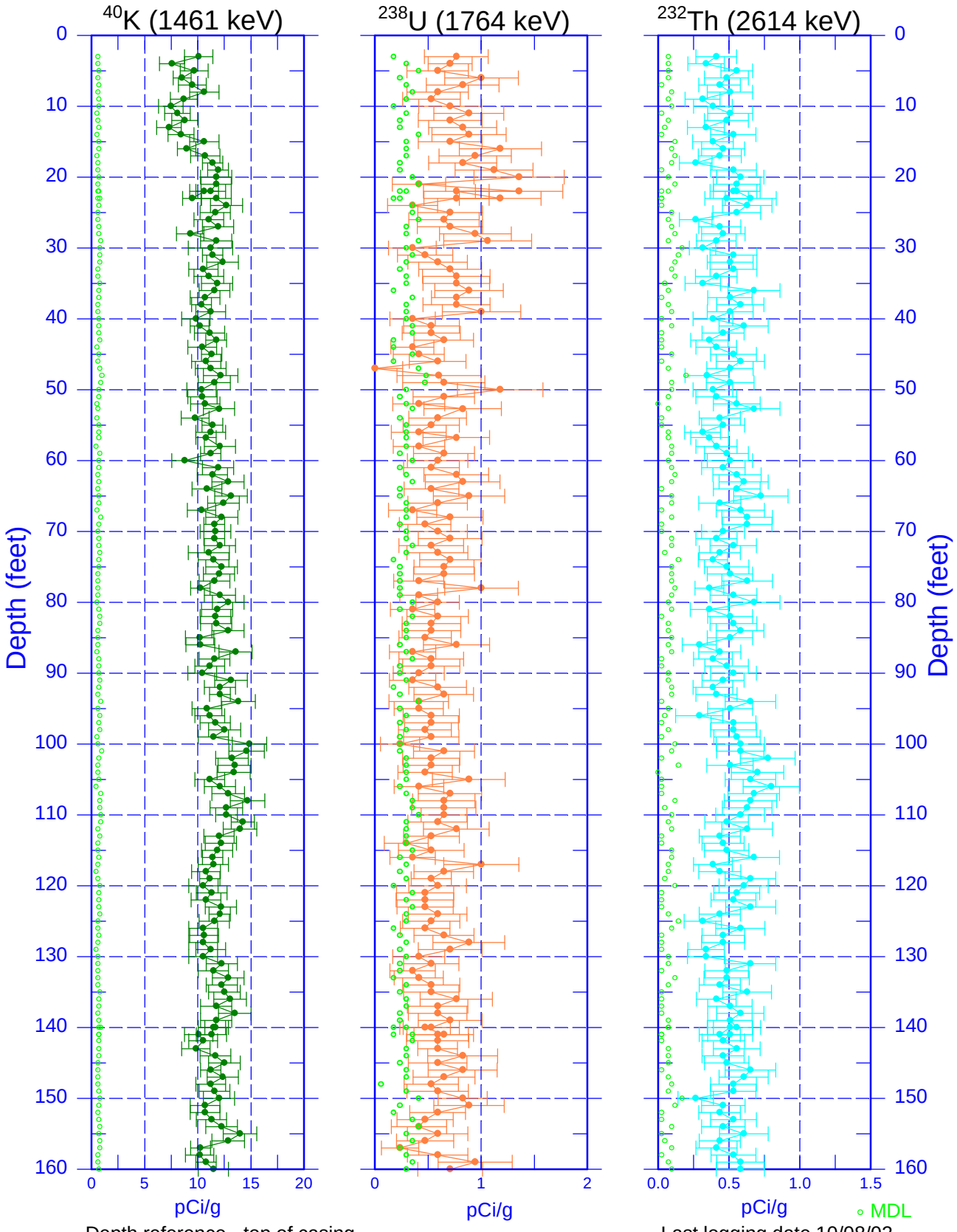


Depth reference - Top of casing

Last logging date - 10-08-02

299-E33-01 (A4838)

Natural Gamma Logs

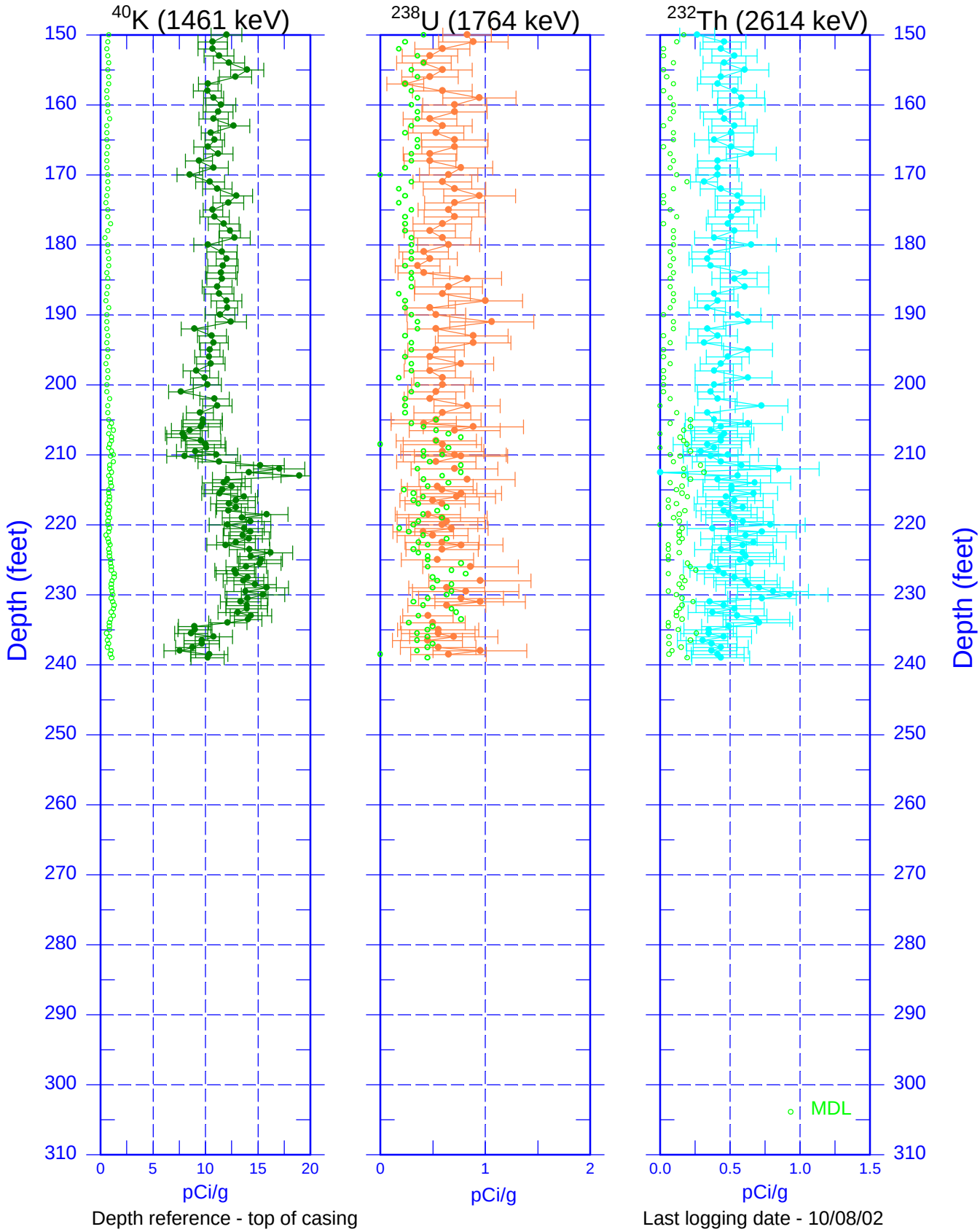


Depth reference - top of casing

Last logging date 10/08/02

299-E33-01 (continued)

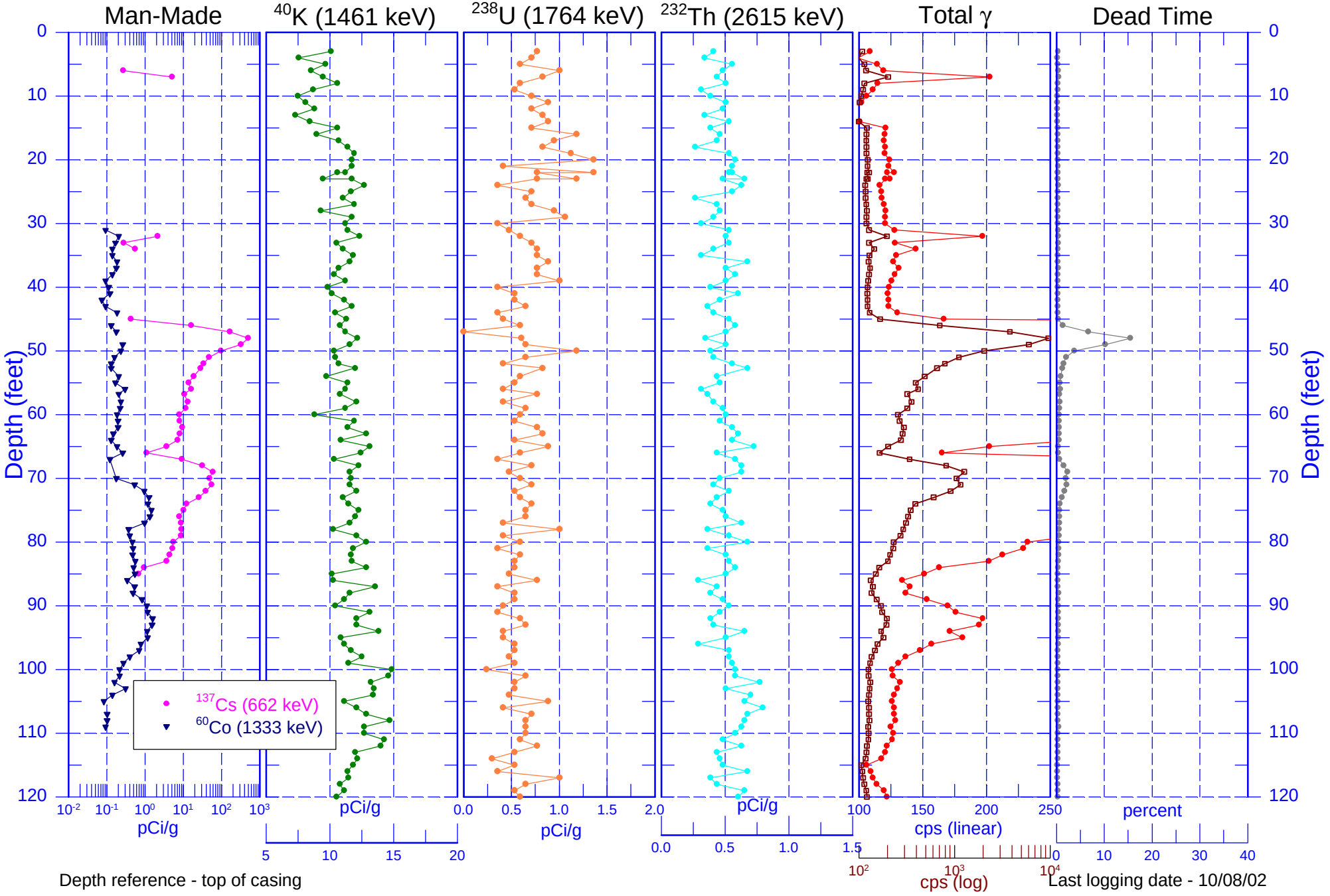
Natural Gamma Logs



Depth reference - top of casing

Last logging date - 10/08/02

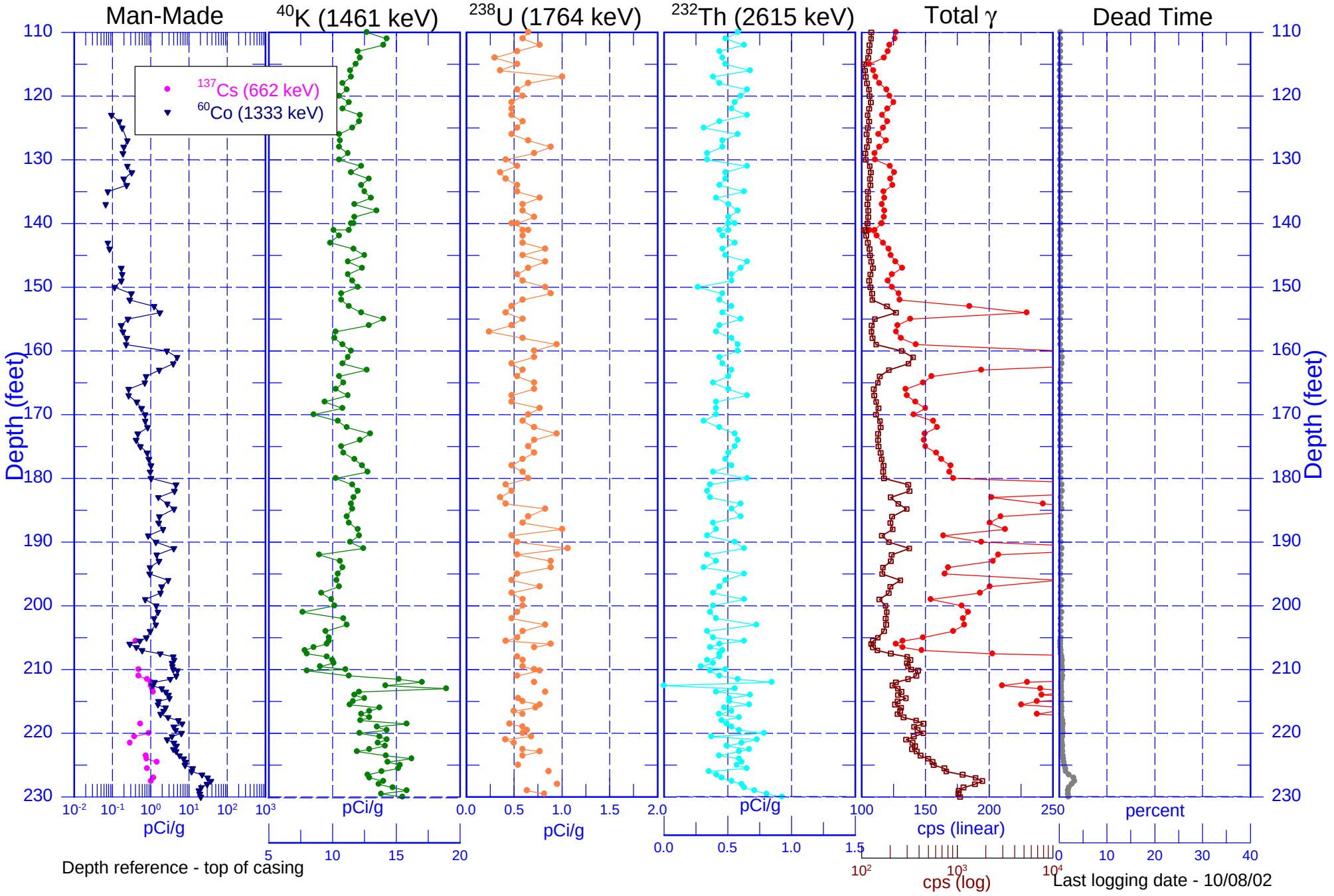
299-E33-01 (A4838) Combination Plot



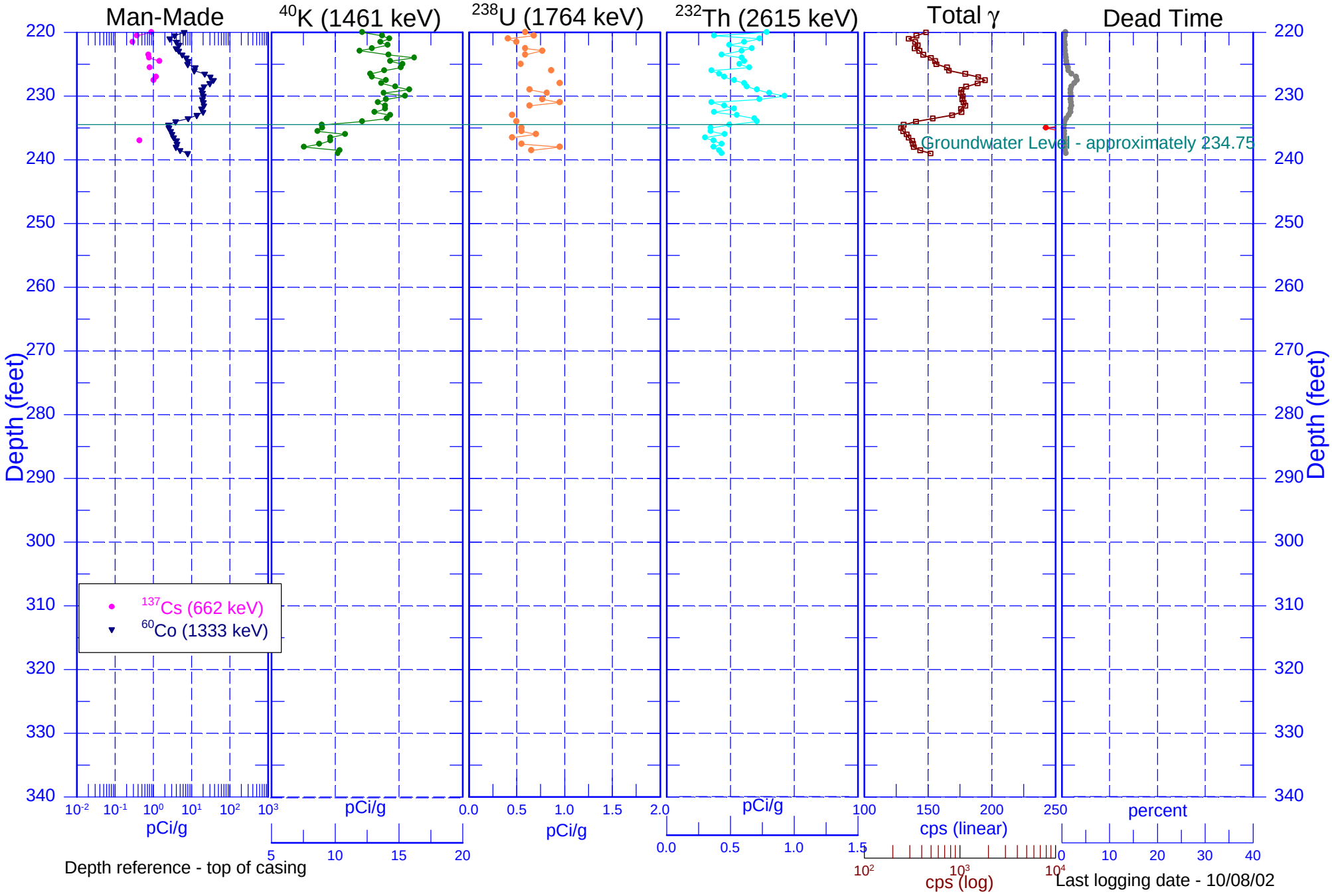
Depth reference - top of casing

Last logging date - 10/08/02

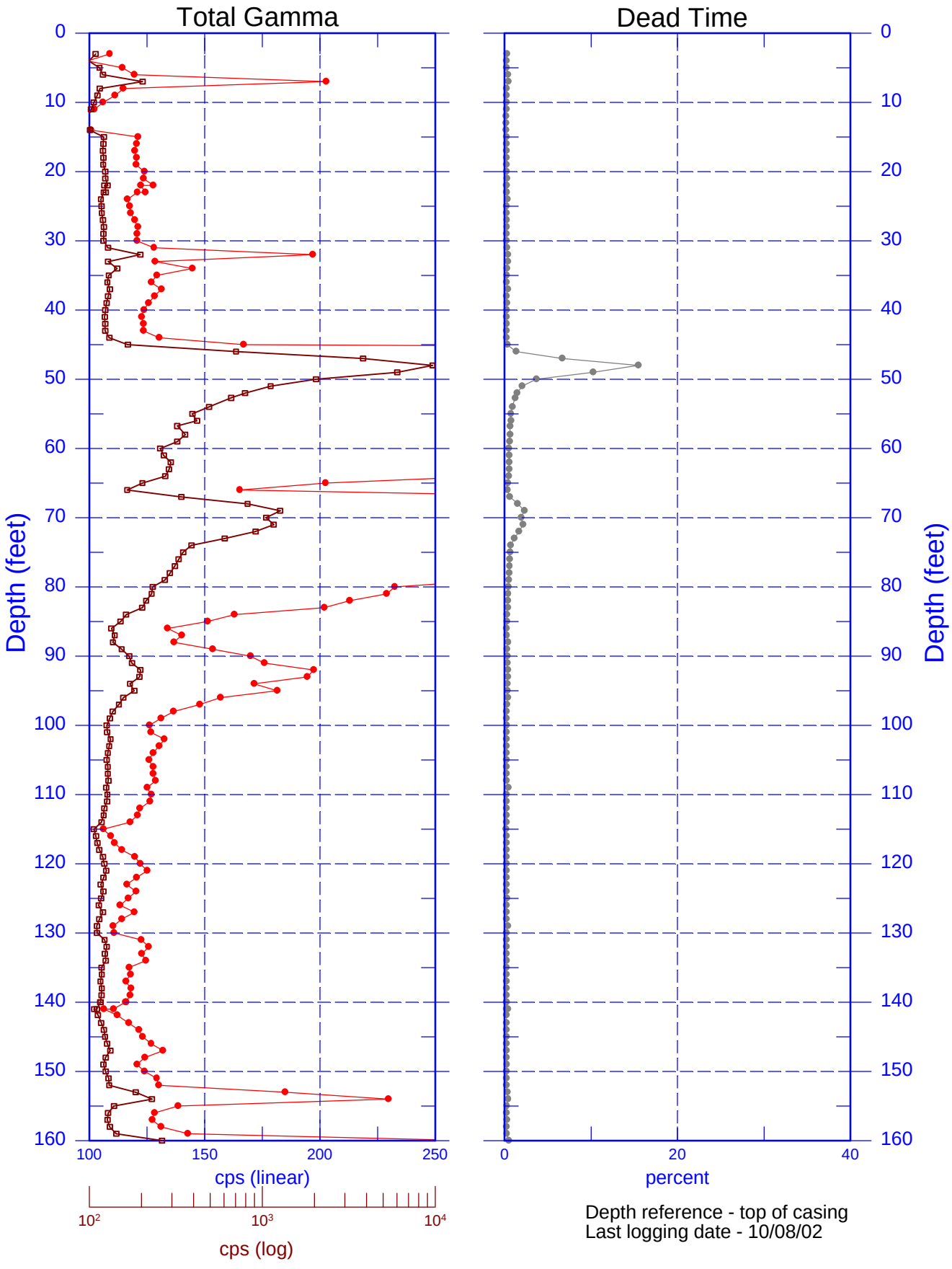
299-E33-01 (A4838) Combination Plot



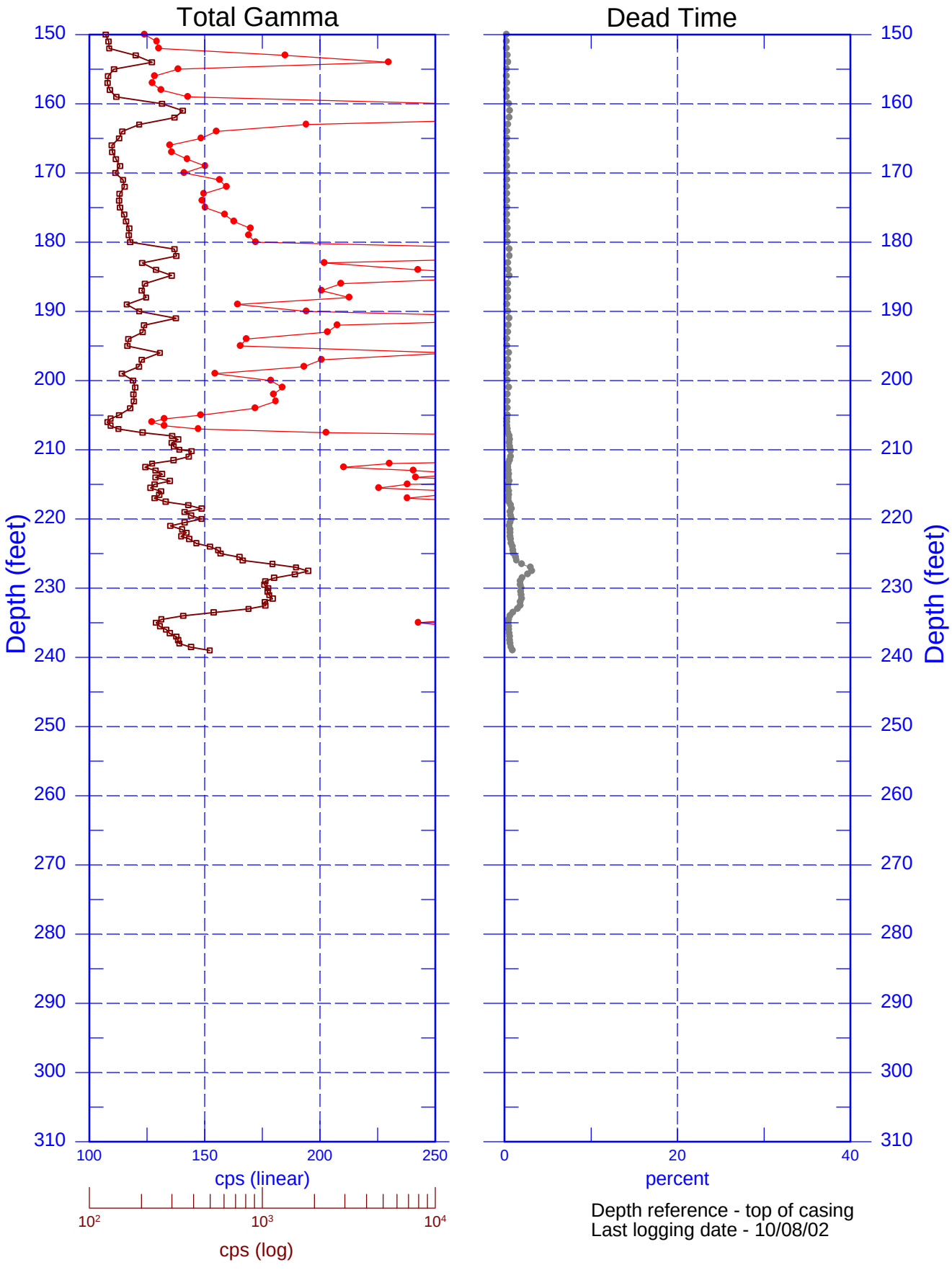
299-E33-01 (A4838) Combination Plot



299-E33-01 (A4838)
Total Gamma & Dead Time

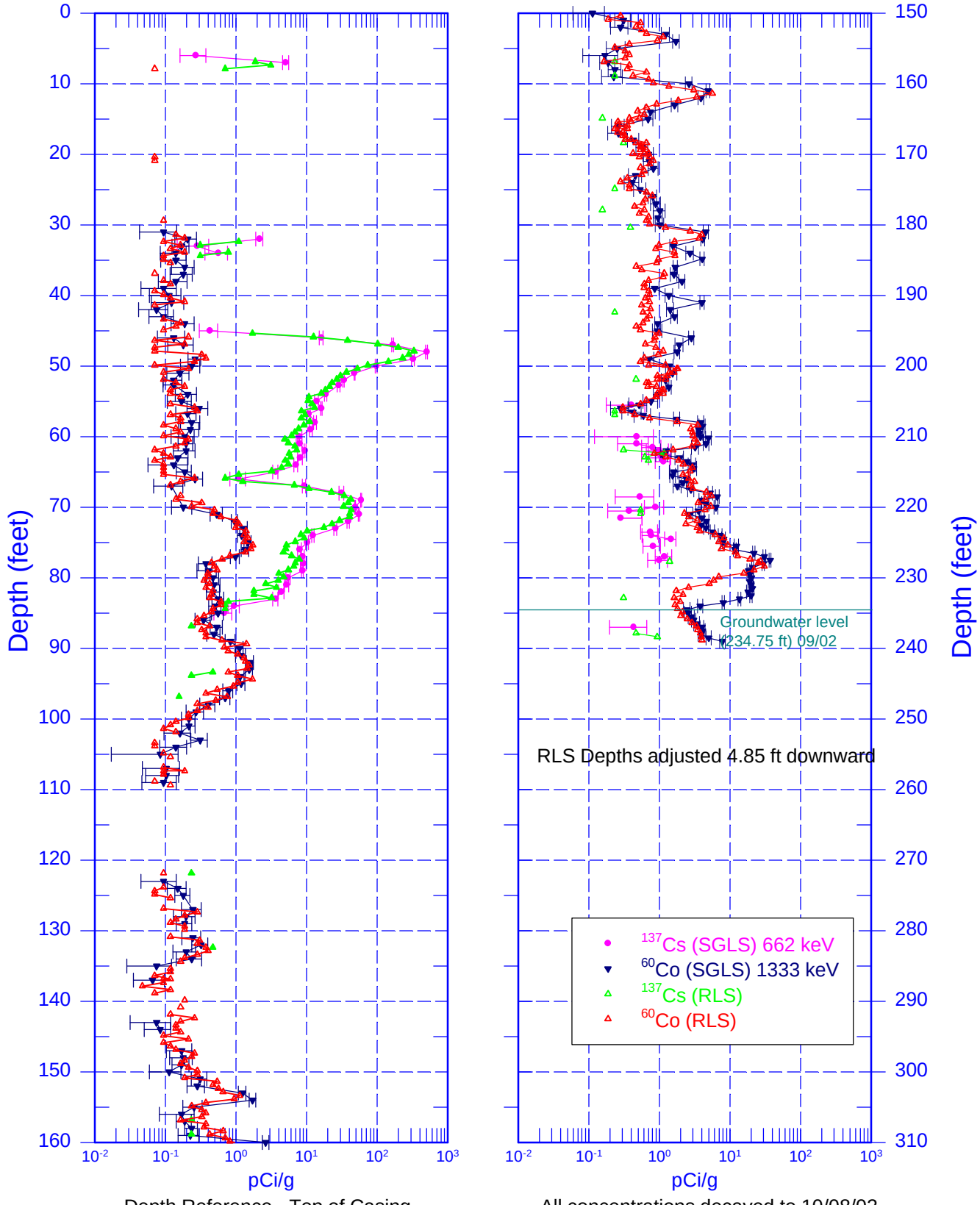


299-E33-01 (A4838)
Total Gamma & Dead Time



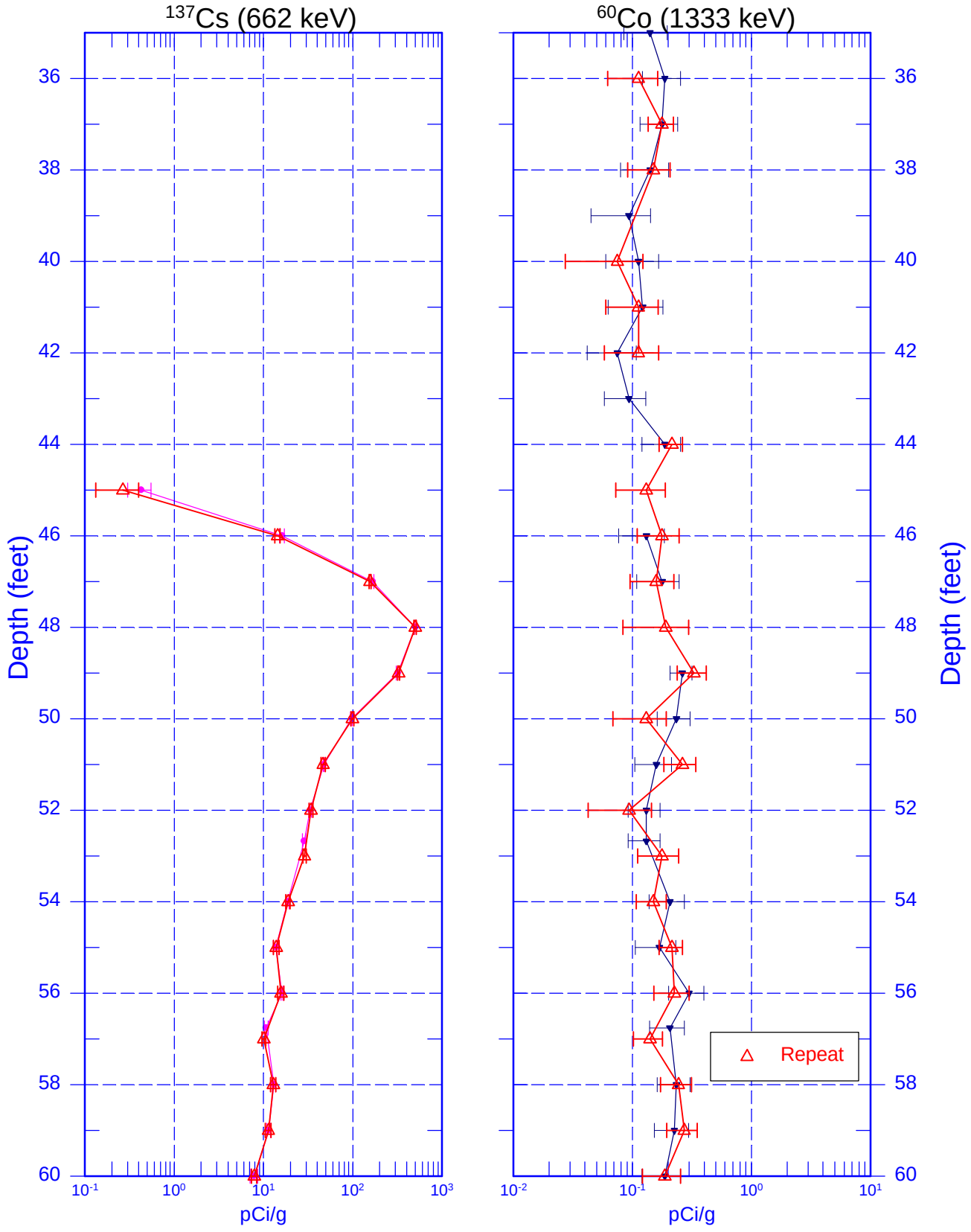
299-E33-01 (A4838)

RLS (1991) and SGLS (2002) Comparison Logs



299-E33-01 (A4838)

Repeat Section of Man-Made Radionuclides



Depth reference - Top of casing

Last logging date - 10-08-02

299-E33-01 (A4838)

Repeat Section of Natural Gamma Logs